

Characterization of thin diamond windows using coherent scattering

Kenji Tamasaku^{1,2}, Yukio Takahashi^{1,2}, Yoshinori Nishino¹, Tetsuya Ishikawa¹

¹RIKEN SPring-8 Center, 1-1-1 Koto, Sayo-cho, Sayo-gun, Hyogo, 679-5148 Japan

²Dep. of Precision Science and Technology, Graduate School of Eng., Osaka Univ., 2-1 Yamadaoka, Suita, Osaka 565-0871 Japan

The construction of free-electron lasers (FEL) forced reconsideration of x-ray optical elements, such as monochromator crystals, terminating windows, and attenuators. One of the rigorous requirements for the optics is to handle the unprecedented peak power of FEL pulse, e.g. ~10 GW. The peak power is estimated to be close to the threshold of non-thermal melting for most materials. This estimation recommends low-Z materials. Other requirement is coherence preservation of the FEL beam. Considering these points, diamonds may be a good candidate for standard optical elements of FEL.

The coherent scattering technique was used to investigate how diamond windows and/or attenuators affect the coherent beam. The sample was high-quality synthetic type IIa diamond crystals with the (100) surfaces. If the sample had been ideal, no pattern should have been observed. However, the measured image shown below had an oblique streak, and two independent fringes. Note that the vertical and the horizontal streaks were artifact. The origin of the observed features and the relation to the surface and the bulk quality of the sample will be discussed.

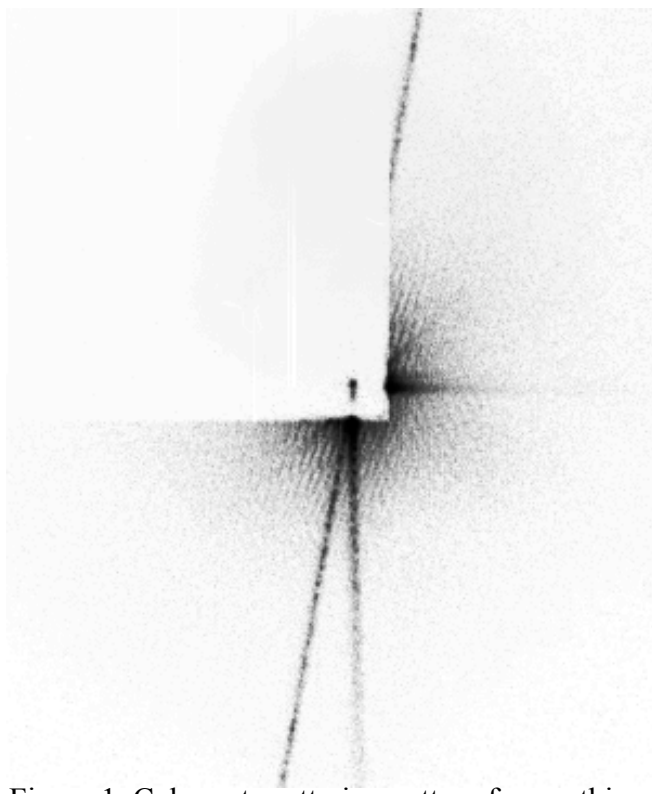


Figure 1. Coherent scattering pattern from a thin diamond window.